tive as distributors of heat. The temperature would hence become approximately proportional to the solar accession, which has been computed by Much for the various latitudes, and may be roughly reduced to thermometrical degrees by means of an easily determined constant. Moreover the presence of the ice would greatly facilitate both radiation and direct reflection of solar energy. The general diminution of temperature produced in this manner is calculated for each latitude; and from a comparison of these figures with actual temperatures, as recorded by Dove, the temperature of the whole hemisphere when the ice-sheet extends to any latitude is also computed. From the several figures obtained it appears that if the globe were encrusted with ice, the crust would probably (and indeed almost certainly) never be melted unless by proper terrestrial heat; while the temperature in polar regions, as well as over much of the ice-covered hemisphere, would sink so low as to practically eliminate all aqueous vapor and effectually prevent the further accumulation of ice. The annual variations in solar intensity would not materially affect the values obtained.

Since the results reached in the manner indicated embody values widely different from those of existing temperatures, and are hence *a priori* improbable, a detailed investigation of certain meteorological phenomena is undertaken in order to verify these results. The observed and computed temperatures of the northern hemisphere are first compared, and are found to indicate that the temperature-equalizing agencies are 1.5 times as effective in summer as in winter. The effect of atmospheric dryness in diminishing the effectiveness of these agencies is then found to be still greater. The values developed in the investigation of this subject demonstrate that the climatal perturbations previously pointed out as the necessary result of the considerable extension of a polar ice-sheet do not differ in kind, but only in degree, from those whose constant occurrence is a matter of authoritative record; and analogy with observed phenomena moreover indicates that the calculated extent of these vicissitudes is in perfect harmony with the magnitude of the formulated course.

The figures obtained incidentally demonstrate the existence of an empirical meteorological law, which may be stated as follows: *Any increase in thermometrical range is accompanied by a diminution in mean temperature.* Since the law strongly corroborates the results reached by the second line of investigation, it is quite fully considered, especially in its application to the present condition of the two hemispheres. That hemisphere whose winters occur in aphelion experiences a greater variation in solar accession and consequently in temperature than the opposite one, and hence, according to the law, ought to have a lower mean annual temperature. The southern hemisphere is so situated at present; and accordingly, notwithstanding more favorable geographical and other conditions, its temperature is lower than that of the northern hemisphere. The bearing of the law on Croll's celebrated theory of secular variations in terrestrial climate is manifest.

Since it is developed in both lines of investigation that the accumulation of glacier ice is dependent upon, and in a general way proportional with, precipitation, the maximum accumulation at any latitude may be roughly computed. The final determination is as follows:

Latitude	40°	18,594 feet.
"	50	9,777 "
"	60	5,728 "
"	70	2,800 "
"	80	1,799 "
"	90	1,440 "

It may accordingly be concluded that a sufficient accumulation of polar ice to displace seriously the earth's center of gravity, or to influence the motion of middle-latitude glaciers, never can have taken place.

The nature and course of ice motion are discussed at some length; and the phenomenon is shown to be analogous to those exhibited by all classes of substances, though generally in a less striking degree. The "viscous theory" of Forbes is adopted with some modifications; and the principal objections thereto are considered. It is also pointed out that ice-streams are necessarily in tension, and hence that the central mass of an ice-field can exercise an influence on the motion of its peripheral portions. The assumption of a vast polar ice-cap to explain the motion of the quaternary glaciers accordingly appears to be not only unnecessary but incompetent.

GLUCOSE.

By Albert E. Ebert, Peoria, Ill.

The process of making glucose, or grape sugar, is as follows: corn, after being shelled, is placed in large tubs and soaked in hot water from a day and a half to five days, or even longer, the time depending on the hardness of the grain. If fermentation is not wished, the water is changed when the substance begins to sour. It is then ground, while wet, with ordinary burr stones, and with a stream of water running into the hopper with the corn. The meal, or "chop," is then run on vibrating sieves, made of fine silk bolting cloth, also fed with streams of water. By this treatment the starch, which washes through the sieves, is separated from the gluten and cellular matter, which waste portions go over the tail of the sieves, and after passing through rollers which squeeze the mass, and return the water to the sieves, is sold for feed. The portion which went through the sieves is run into tanks and settled, the water drawn off and the sediment again mixed with clean water and treated with alkali, about one pound of caustic soda, (more or less, according to the hardness of the water), being used for each bushel of corn. This treatment separates any traces of gluten from the starch, which is then run into metal-lined troughs or gutters about eight inches deep, from fifteen to thirty-six inches wide, and usually from one hundred to one hundred and fifty feet long. These are inclined slightly, and the water runs off at the lower end, leaving the starch as a sediment at the bottom. In some factories this starch mixture goes direct from the sieves to the gutters or "tables," as they are usually called. It is left to dry somewhat in the tables, and is then shoveled out. At this stage of the process it is known as "green starch." It is quite solid, but moist, containing about fifty per cent. of water.

Up to this point the process is the same as starch-making. Starchmakers take the green starch and wash it, some several times, by mixing it with clean water and allowing it to settle, then drawing off the water, and repeating the process. It is then sometimes bleached by chloride of lime or sulphurous acid, and after washing, settled, made into blocks about eight inches square, when it is dried in a kiln. For the finer grades, about half an inch of each side of the cake is shaved off when partially dry, the rest of the cake being wrapped in paper and put back into the kiln until it forms into little sticks or pipes.

For glucose, however, the green starch is made quite thin with water, and run into converters, usually after several additional washings. The converters are large wood tanks or tubs, where it is treated with acids, sulphuric being usually used, although muriatic, nitric, or even oxalic may be substituted. Sulphuric is preferred, as it is cheap and easily gotten rid of in an after stage of the process, when it has performed its work. The acid does not combine with the starch, but merely exerts a catalytic action; therefore the necessity of providing for its removal. While under the acid treatment the contents of the converters are heated to the boiling point by

means of steam pipes coiled inside the tubs, or by steam jets. Some use pressure converters, which are iron or copper tanks like a boiler, when the conversion is much quicker. The operator makes frequent chemical tests to determine when the starch is entirely converted into sugar, and when this is accomplished the mixture is drawn into another vat where the acid is neutralized with some form of carbonate of lime, as marble dust, chalk or whiting. The liquid is sometimes bleached by the use of sulphurous acid at this stage of manufacture. It is now a very dilute solution of glucose, and besides incidental impurities, contains sulphate of lime formed by the action of the sulphuric acid on the carbonate, and whatever carbonate of lime was used in excess of the sulphuric acid present. These are separated by straining through cloth or bag filters and afterward percolating through columns of bone charcoal, eight or ten feet deep. When decolorized, it is drawn into the "vacuum pan," which is a large, strong tank of iron or copper, with steam pipes coiled inside for heating, and from which the air is partially exhausted by an air pump, and in which the syrup is boiled down at a temperature of 100° to to 145°. When concentrated to a specific gravity of about 1400 it is drawn off and again strained or filtered, and is ready for the market as glucose, this being the commercial term for the syrup only. The term grape sugar is applied to the dry glucose, and this is produced by carrying the conversion further before neutralization.

The syrup is used, principally, for mixing with dark colored cane syrup for making light colored table syrups (nearly all the table syrups now sold contain it, and frequently from 75 per cent. to even a larger quantity), and also in making wine, ale, beer and vinegar. On a smaller scale it is used in tobacco manufacture, the adulteration of honey, fruit preserving, etc. Both the solid and liquid forms are largely used in candy making, for which it has several marked advantages. A syrup is prepared expressly for this use, in which the conversion of the starch into sugar is only partial, the syrup containing, of its solid matter, about eighty per cent. of the intermediate product, dextrin, and twenty of glucose. The large consumers of glucose require slightly different syrups. Wine growers, for instance, use a syrup free from dextrin. Brewers desire a very small proportion of it, to give body to the beer, while vinegar makers use a syrup free from gum. The dry glucose, or grape sugar, seems, aside from its legitimate use in candy making, to be most largely in demand for the adulteration of cane sugar. No objections, save of a moral and financial nature, can be urged against this, but it is well to remember that for its value as a sweetener, compared with cane sugar at ten cents per pound, glucose is worth but four cents. So much has been written against the manufacture of glucose, on account of its use as an adulterant of cane sugar, that it is, perhaps, only just to say that it is certainly the least objectionable of any of the articles used for that purpose. It is perfectly wholesome, being in fact the physiological sugar, and has about two-fifths the sweetening power of cane sugar, which is more than can be said of terra alba, starch, bone dust, sand, etc., while its most probable impurity, calcium sulphate, can, from its insolubility, be present only in minute quantity, probably not more largely than in most potable waters, and is not in any sense noxious.—*The Druggist.*

METEOROLOGICAL REPORT FOR NEW YORK CITY FOR THE WEEK ENDING NOV. 19, 1881.

Latitude 40° 45′ 58″ N.; Longitude 73° 57′ 58″ W.; height of instruments above the ground, 53 feet; above the sea, 97 feet; by self-recording instruments.

NOVEMBER.	BAROMETER. Mean for the Day. Reduced to Freezing.	Maximum. Reduced to Freezing.	Maximum. Time.	Minimum. Reduced to Freezing.	Minimum. Time.	THERMOMETERS. Mean. Dry Bulb.	Mean. Wet Bulb.	Maximum. Dry Bulb.	Time.	Wet Bulb.	Time.	Minimum. Dry Bulb.	Time.	Wet Bulb.	Time.	Maxi'm In Sun
Sunday, 13	29.636	29.790	12 p. m.	29.542	1 a. m.	51.6	49.0	59	0 a. m.	58	0 a. m.	42	12 p. m.	42	12 p. m.	115.
Monday, 14	29.937	30.002	9 p. m.	29.790	0 a. m.	46.3	43.6	53	2 p. m.	48	2 p. m.	40	5 a. m.	40	5 a. m.	106.
Tuesday, 15	30.214	30.442	12 p. m.	29.976	1 a. m.	41.3	38.3	46	4 a. m.	43	3 a. m.	36	8 a. m.	34	8 a. m.	104.
Wednesday, 16	30.500	30.550	9 a. m.	30.442	0 a. m.	39.7	38.0	45	4 p. m.	41	4 p. m.	33	6 a. m.	33	6 a. m.	101.
Thursday, 17	30.327	30.464	0 a. m.	30.138	12 p. m.	47.6	45.7	55	3 p. m.	51	4 p. m.	37	8 a. m.	37	8 a. m.	110.
Friday, 18	29.869	30.138	0 a. m.	29.690	12 p. m.	58.3	55.6	61	2 p. m.	58	12 p. m.	52	0 a. m.	50	0 a. m.	82.
Saturday, 19	29.669	29.798	12 p. m.	29.600	1 p. m.	50.3	49.3	61	0 a. m.	58	0 a. m.	45	12 p. m.	43	12 p. m.	62.

Mean for the week .... 30.021 inches.
Maximum for the week at 9 a. m., Nov. 16th .... 30.550 "
Minimum " at 1 a. m., Nov. 13th .... 29.542 "
Range .... 1.008 "

	Dry.		Wet.
Mean for the week	47.8 degrees		45.6 degrees.
Maximum for the week, at 2 pm. 18th	61. "	at 12 pm 18th,	58. "
Minimum " " 6 am. 16th	33. "	at 6 am 16th,	33. "
Range " "	28. "		25. "

NOVEMBER.	WIND. Direction. 7 a. m.	2 p. m.	9 p. m.	Velocity in Miles. Distance for the Day.	Force in lbs. per sqr. feet. Max.	Time.	HYGROMETER. Force of Vapor. 7 a. m.	2 p. m.	9 p. m.	Relative Humidity. 7 a. m.	2 p. m.	9 p. m.	CLOUDS. Clear, 0; Overcast, 10. 7 a. m.	2 p. m.	9 p. m.	RAIN AND SNOW. Depth of rain and snow in inches. Time of Beginning.	Time of Ending.	Duration. h. m.	Amount of water	OZONE. 0–10
Sunday, 13	w. s. w.	w. n. w.	w. n. w.	241	7	3.00 pm	.389	.282	.275	93	62	92	0	1 cir. s.	0	-----	----	-----	--	0
Monday, 14	w. s. w.	w.	e. n. e.	197	$7\frac{1}{4}$	3.30 pm	.235	.269	.251	91	66	84	0	7 cir. cu.	0	-----	----	-----	--	5
Tuesday, 15	w. n. w.	n. n. w.	n. w.	369	$19\frac{1}{4}$	7.30 am	.190	.186	.203	74	67	82	7 cu.	4 cu.	0	-----	----	-----	--	2
Wednesday, 16	n. w.	w. s. w.	w.	143	1	2.00 pm	.188	.208	.231	100	75	83	0	0	0	-----	----	-----	--	0
Thursday, 17	s.	s.	s. s. w.	170	$4\frac{3}{4}$	9.30 pm	.229	.295	.334	100	73	86	0	1 s.	7 cu.	-----	----	-----	--	2
Friday, 18	s. w.	w. s. w.	s. s. w.	258	$5\frac{3}{4}$	11 15 am	.362	.412	.456	86	77	88	9 cu.	9 cu.	10	-----	----	-----	--	0
Saturday, 19	n. n. e.	n.	n. w.	118	$6\frac{3}{4}$	8.00 pm	.335	.374	.309	92	100	85	9 cu.	9 cu.	10	5.15 pm	9 pm	3.45	.03	3

Distance traveled during the week .... 1,496 miles.
Maximum force .... $19\frac{3}{4}$ lbs.

Total amount of water for the week .... 0.05 inch.
Duration of rain .... 3 hours, 45 minutes

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